Space Weather Technical Forecast

Issued on Friday, 28 October 2022 at 13:08 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of G1/Minor geomagnetic storms throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity over the past 24 hours has been Low, with several very low level C-class flares. There are five numbered and one unnumbered sunspot regions on the visible disk. All have a simple magnetic structure. AR3130 and AR3133 have potential to develop into something more significant and these regions will be monitored as they cross the disk. Though AR3133 appears to have decreased in size with the earlier possibility of a delta configuration now looking less likely. The largest region on the visible disc remains AR3131 Cho/Beta also in the northwest, which is stable with a simple magnetic configuration. Newly numbered AR3134 and the unnumbered region in the SW are very weak looking Beta/Bxo groups. No Earth-directed CMEs have been observed.

Solar Wind / Geomagnetic Activity: The solar wind, as observed by DSCOVR at L1 started the period at background conditions with speeds generally just below 400 km/s, then gradually increased to slightly elevated levels, peaking at 476 km/s at 27/2343 UTC, probably due to a weak connection to coronal hole 36. From 28/0800 UTC speeds eased to background again before ending the period slightly elevated around 440 km/s. The density was average or slightly above average peaking at 14.4 ppcc at 28/0959 UTC. Total IMF strength was generally weak, but did peak at 10 nT at 27/1729 UTC as the weak High Speed Stream arrived. The north-south component, Bz, varied between 5nT and -7nT, and was often weakly negative (southward) direction. The phi angle was predominantly positive (away from Sun) until 28/0200 UTC, subsequently fluctuating between positive and negative sectors. Geomagnetic activity was Quiet to Unsettled (Kp 2-3).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has remained at background levels. High energy electron flux (greater than 2MeV) at GOES-16 was predominantly at background levels. The associated 24-hour integrated fluence was well below the Active (1e8 integrated pfu) threshold, with 1.24e6 integrated pfu observed at 28/0001 UTC.

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Met Office Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be mainly Low, but with a daily slight chance of isolated M-flares due to the developing sunspot regions on the disc. These most likely from AR3130 or AR3133.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. Coronal hole fast wind enhancements are expected at times throughout the period. The connection with CH36/+ observed at present may wane before the High Speed Stream from CH37/+ arrives later day 2 (29th) and into day 3 (30th), with slightly elevated or elevated winds persisting until the end of the period (31st). Quiet to Unsettled (Kp 2-3) geomagnetic activity at first, with a chance of isolated Active (Kp 4) intervals. Then from late day 2 (29th) mainly Unsettled to Active activity is expected, with a chance of a G1/Minor geomagnetic storm (Kp 5).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10MeV) observed by GOES-16 is expected to be at background levels. High energy electron flux (greater than 2MeV) observed by GOES-16 is expected to be at background levels initially, then gradually rising to mainly moderate levels by the end of the period, perhaps high through the diurnal maximum. The associated 24 hour electron fluence is expected to remain below the Active threshold.

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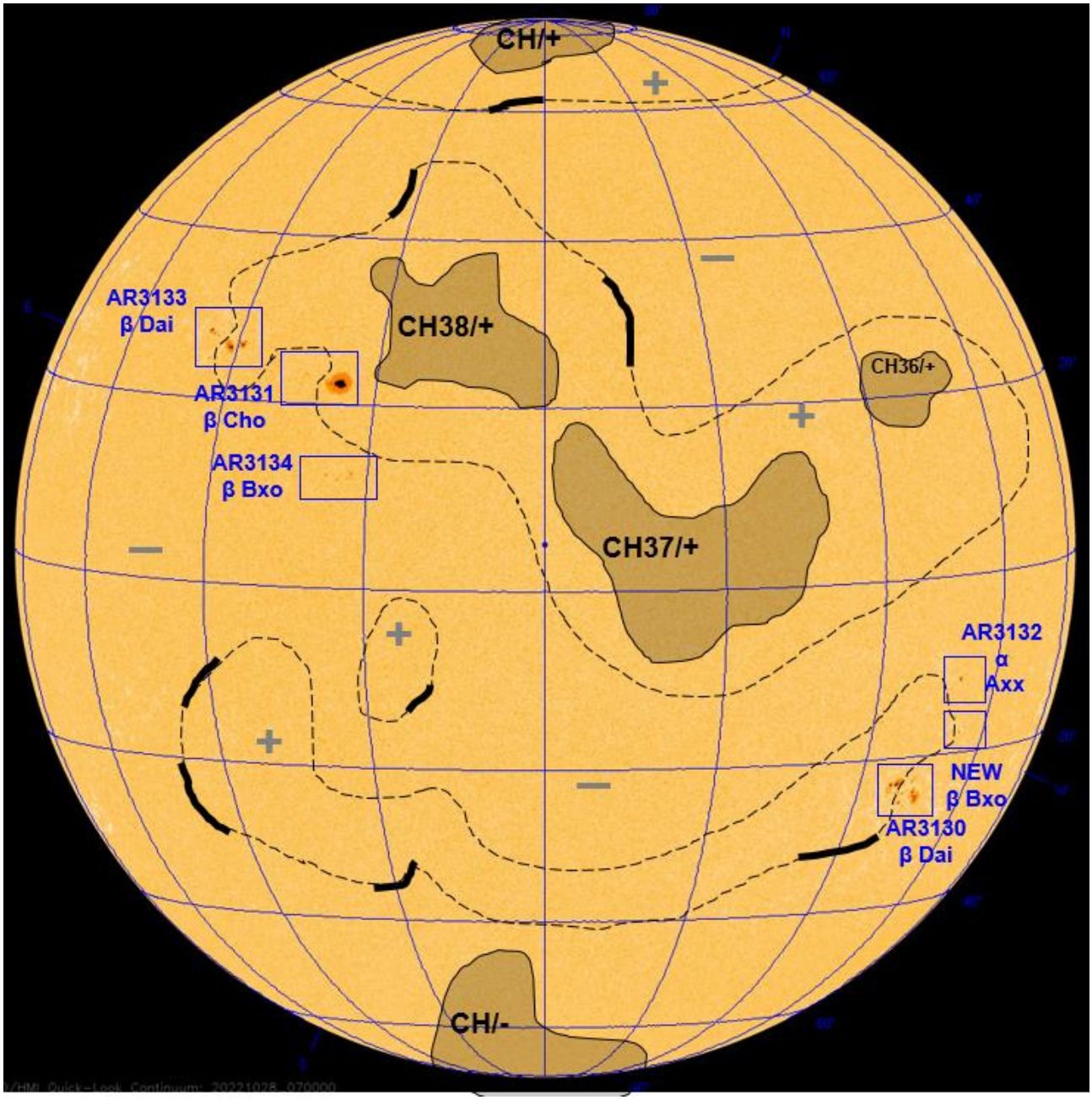
Figure 1. Solar Analysis Valid 28/0700 UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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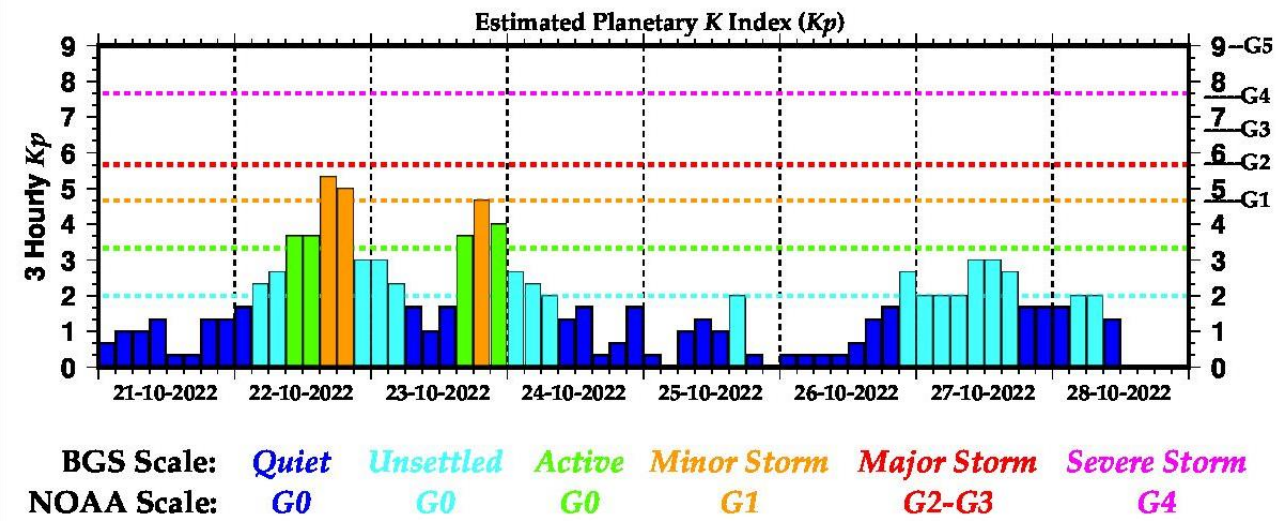
Geomagnetic Storms:

There are no Earth-directed CMEs.
There are a series of coronal holes on the Earth-facing disc. These are recurrent features, with solar wind persistence from the last 27 day rotation providing a good guide to likely conditions. CH36/+ is the leading coronal hole, with the associated HSS having already arrived and probably now waning, with wind speeds probably 350-450 km/s on day 1 (28th). The next HSS is expected to arrive late day 2 (29th) from CH37/+, with speeds reaching 500-550 km/s through days 3 and 4 (30th-31st). Another HSS from CH38/+ may arrive late on day 4 (31st), maintaining the elevated wind speeds.
Quiet to Unsettled (Kp 2-3) geomagnetic activity at first, with a chance of isolated Active (Kp 4) intervals. Then from late day 2 (29th) mainly Unsettled to Active activity is expected, with a chance of a G1/Minor geomagnetic storm (Kp 5), especially late tomorrow into day 3 (30th).

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	20	40	40	40
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections - Nil

Figure 2: BGS Kp index.



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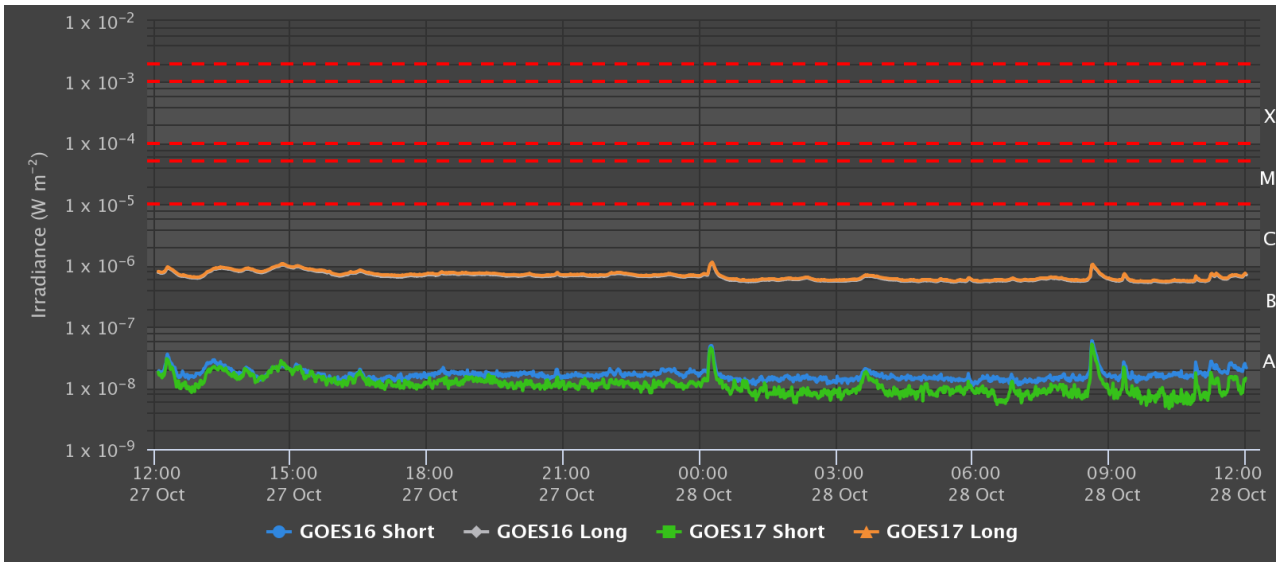
Radio Blackouts - X-Ray Flares:
Solar activity over the past 24 hours has been Low, with several very low level C-class flares. There remains a slight chance of activity increasing to Moderate, with isolated M-flares. These most likely from AR3130 in the southwest, or AR3133 in the northwest, with lower chances from the other regions.
A further source of potential activity is a large region of magnetic looping notable on SDO imagery on the northeast limb. This is supported by a strong signal in helioseismic products, suggesting the potential for a further notable region or regions to rotate onto the northeast disc through the period.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	10	10	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES16 X-Ray flares



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as observed by GOES16 is currently at background. The current sunspot regions on the solar disc are unlikely to produce observable radiation storms at Earth, although a very slightly above background risk has been introduced due to AR3130 in the southwest quadrant.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	2	2	2	2
Very Active	≥ S3 *	No	1	1	1	1

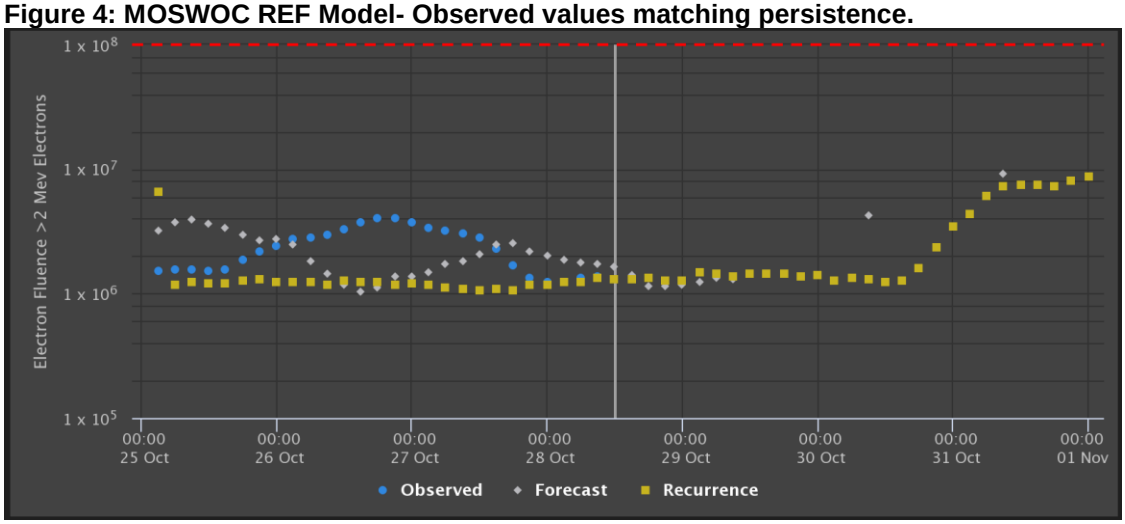
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

High Energy Electrons Event (≥ 2MeV):

The high energy (greater than 2 MeV) electron flux as measured by GOES-16 has been largely at background levels. Throughout the period the solar wind is expected to be at slightly elevated to elevated levels, with the flux gradually increasing to mainly moderate levels, perhaps peaking at high levels during day 4 (31st).
The associated electron fluence is expected to remain below the Active threshold through the period, but with an increasing trend. This is supported by both REFM and recurrence.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	10	20	30
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 4: MOSWOC REF Model- Observed values matching persistence.



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